WHEAT SPECIAL REPORT No. 50

Milling, Baking, and Grain Factors Influencing the Quality of Tandyr Bread (Nan) in Central Asia

Report on a Study Conducted in Four Countries of Central Asia

September 2002

CIMMYT MR
INTERNATIONAL MAIZE AND WHEAT IMPROVEMENT CENTER

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Milling, Baking, and Grain Factors Influencing the Quality of Tandyr Bread (Nan) in Central Asia

Introduction

During the time of the Soviet Union, the inhabitants of the Central Asian Republics consumed mainly dense, pan-type bread that was mass-produced in large baking plants. However, after CA countries achieved independence, the production of tandyr bread (baked on the walls of concave, clay ovens) rapidly regained popularity throughout the region, to become the main bread type that is consumed today in small cities, and the only type consumed in small villages of the rural areas. Tandyr bread making requires certain grain quality attributes, which seem to be inferior in the winter wheat varieties currently cultivated in CA. Wheat quality for tandyr bread making is not well defined, and therefore it is necessary to determine which wheat quality factors need to be improved through breeding.

This document reports on findings obtained from a survey of the milling and baking industries throughout four countries of Central Asia.

Objectives

The objectives of this study were: To conduct a survey in large to small mills and large to small commercial bakeries and households, using questionnaires to collect information leading to the understanding/perception of tandyr bread quality criteria and of the grain quality requirements for producing tandyr bread of acceptable quality.

Study teams in Kyrgyzstan (a) and Tajikistan (b).

It was also attempted to identify non-grain factors, such as N-deficiency effects, grain sprouting, grain-spoiling agents (insects, fungi) associated with the quality of wheat varieties cultivated in the region.

The survey was conducted from September 07 to September 25, 2002 through four countries (southern Kazakhstan, Kyrgyzstan, Uzbekistan, and Tajikistan) of Central Asia.

Wheat Consumption in Central Asia

After the disintegration of the Soviet Union, the population of countries located in Central Asia (CA) went back to practice more of their traditional (social, cultural, and food) habits, as well as increased their participation in agriculture, a very important and strategic economic activity. Restructuring agricultural infrastructure towards food security and profitability has become one of the main priorities in countries of CA.

Special attention has been given to wheat, the main cereal crop in the region and the raw material for making bread, which is a staple food consumed in every meal as an important, and in some areas as the main, source of nutrients.

Given the prime role wheat production plays in the region, several activities are currently underway to promote wheat productivity in sustainable agricultural systems. Most countries in CA grow mainly winter wheat, whose quality attributes (protein quantity and quality) are generally inferior to those of spring wheat grown in northern Kazakhstan. In fact, inferior quality is one of the main reasons (another: lack of and/or inconsistent local wheat supply) why the milling and bread-making industries of southern Kazakhstan, Kyrgyzstan, and Tajikistan (wheat imports are not permitted in Uzbekistan) prefer high-quality spring wheat (and wheat flour) from northern Kazakhstan over local winter wheat varieties (Table 1, 3). Large quantities of wheat and flour are imported from northern Kazakhstan despite their higher prices (Figure 1).

Table 1. Wheat flour mills survey. Large to small flour mills with several sets of rolls and producing extra, first and second grade refined flours.

					First-grade flour				
Country County	City/town	Status	Milled ton/day	Origin of wheat supply	Flour ash (%)	Wet gluten in grain (%)	Wet gluten in flour (%)	Gluten strength	Flour quality for tandyr bread
Kazakhstan									
Almaty	Chemolgan	private	170-180	NKazakh	0.7	nd	29	Strong	Good
Kyrgyzstan									
Chu	Bishkek	private (service)	3-4	Local	0.7-0.8	nd	nd	weak	Poor
Chu	Bishkek	private	3-4	NKazakh	0.7-0.8	>24	29	strong	Good
Chu	Bishkek	private	120	75% NKazakh/25% local	0.7-0.8	nd	26-27	medium	Good
Chu	Bishkek	private	125	NKazakh	0.75	>26	>31	strong to medium	Good
Chu	Bishkek	private	30	NKazakh	0.75	>26	31	medium	Good
Osh	Osh	private	2	55% NKazakh/45% local	0.7	24	27	medium	Good
Osh	Karassu	private (service)	3-4	Local	nd	nd	nd	weak (low protein)	Only source
Uzbekistan									
Andijan	Assaka	State/private	150	Local	0.9	nd	26-28	medium	Good
Tashkent	Fargona	State	400	Local	nd	nd	nd	weak (low protein)	Only source
Tashkent	Tashkent	State	100	local	0.9	nd	27-28	weak to medium	Satisfactory
Tashkent	Tashkent	Private	18	Local	0.74	20	25	weak	Satisfactory
Tajikistan									
Sogdyi	Gafurov	Private	12	Local	nd	<22	nd	weak	Satisfactory
Sogdyi	Gafurov	Private	24	NKazakh	nd	25-27	nd	medium to strong	Good
RRS	Kafarnihon	State/private	50	Local	nd	25	nd	weak to medium	Satisfactory
RRS	Dushanbe	Private	5	Mostly Kazakh/local	nd	nd	nd	medium	Good

nd: not determined

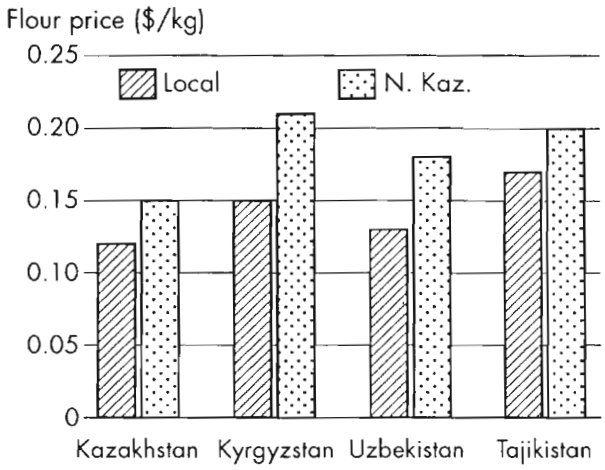


Figure 1. Flour prices in Central Asian countries. 1USD=154 Kazakhstan tenye; 46 Kyrgyzstan som; 1100 Uzbekistan som; 3 Tajikistan somoni.
Source: Ayhan Atli.

Tandyr Bread

Bread dough formula and processing

Tandyr (clay oven in local language) bread is made of slightly salty water-flour (water: 50-60% of flour weight) dough, fermented with yeast or, in small villages, with sour dough. Milk and oil are sometimes added (Table 4). The dough is made by hand, mixing all the ingredients and then kneading until the dough is cohesive and slightly rough to smooth. Dough roughness (or smoothness) and consistency depends on the quality (gluten strength) of the flour as well as on the baker's preference (Table 4). The dough is allowed to ferment from 60 to 180 min. After fermentation the dough should be elastic and slightly extensible, so it can be flattened and shaped into thick to thin dough discs, which are stamped in the center before they are baked. The discs are stuck on the inner walls of a preheated, concave, clay (or clay-brick) oven. The dough is usually moistened with milk before baking to yield a shiny bread surface.

Bread characteristics

Tandyr bread, commonly known as "nan," or "lepyoshka" in Russian, is round-to-oval-shaped, and may be small, medium, or large in size (diameters of 15-20, 20-30, and 30-40 cm, respectively). The bread discs may be 5 to 10 cm thick (Table 5). The crust, stamped with varying designs, may be from light to dark brown and thin or thick. Taste, crumb texture (non-sticky while masticating), and satiation capacity are among the most important bread characteristics the consumer looks for in tandyr bread.

Making tandyr bread.

Tandyr bread may be light, with open crumb weighing from 180 to 360 g; medium dense, with slightly open crumb weighing between 180 and 750 g, depending on size; or dense to very dense, weighing from 400 to 850 g (Table 5). Lightweight breads usually accompany a full meal (mainly in urban areas), while dense breads are actually the main component of a meal, as happens frequently among the resource-poor population in the rural areas of CA.

Table 2. Wheat flour mills survey. Small service flour mills (Chinese type) with one set of rolls and producing first and second grade refined flours and whole grain flour.

Country County	City/town	Status	Milled ton/day	Origin of wheat supply	Flour Ash (%)	Wet gluten in grain (%)	Wet gluten in flour (%)	Gluten strength	Quality for tandyr bread
Kazakhstan									
Almaty	Uzin-Agash	private (service)	8-10	Local	nd	nd	nd	nd	Poor
Uzbekistan									
Andijan	Janabad	Private (service)	1	Local	nd	nd	nd	weak (low protein)	Only source
Tashkent	Navoyi	Private (service)	0.7	Local	nd	nd	nd	weak (low protein)	Only source
Tajikistan									
Sogdyi	Gafurov	Private (service)	0.8	66%NKazakh/33% local	nd	nd	26	medium	Good/satisfact.
Khatlon	Sargazan	Private (service)	0.5 stone	Local	nd	nd	nd	weak	Only source
RRS	Kofarnihon	Private (service)	0.4 stone	Mostly local/NKazakh	nd	nd	nd	weak to medium	Satisfactory

nd: not determined

Table 3. Tandyr bread-making survey. Flour origin, flour type, and bread production.

Country/County	City/town	Origin of flour (grain source)	Flour blend	Flour type	Breads made per day
Large to small commercial bakeries					
Kazakhstan					
Almaty	Almaty	NKazakh	no	1st grade	200
Almaty	Chilik	NKazakh	no	1st grade	800
Kyrgyzston					
Chu	Novopokrovka	Nkazakh-local	70-30	1st grade	460
Chu	Alexandrovka	Nkazakh-local	nd	1st grade	220
Osh	Osh	Nkazakh	no	1st grade	900
Osh	Osh	NKazakh	no	1st grade	330
Uzbekistan					
Andijan	Andijan	Nkazakh-local	50-50	1st grade	750
Andijan	Andijan	local	no	2nd grade	500
Andijan	Assaka	local	no	1st grade	560
Namangan	Namangan	NKazakh-local	50-50	1st grade	800
Tashkent	Ukarachirzik	NKazakh-local	nd	1st-Uzbek	2000
Djizak	Gala-aral	Nkazakh-local	mostly local	1st grade	600
Tajikistan					
Sogdyi	Gafurov	NKazakh-local	50-50	extra-first	800
Sogdyi	Isfara	NKazakh	no	1st grade	470
Khatlon	Dangara	NKazakh	50-50 if NK scarce	2nd grade	1500
Dushanbe	Gissar	NKazakh	no	1st grade	300
Household bread-making (for sale)					
Kazakhstan					
Almaty	Uzin-Agash	NKazakh	no	1st grade	60
Almaty	Chilik	NKazakh	no	1st grade	80
Kyrgyzstan					
Osh	Osh	NKazakh	yes, nd	1st grade	56
Household bread-making (family consumption)					
Kyrgyzstan					
Chu	Kant	flour from own crop		1st grade	8-10
Osh	Tasharyk	flour from owned Chinese mill		2nd grade	8
Uzbekistan					
Andijan	Jana-Abad	local	no	1st grade	5-6
Namang.	Jide-Kapa	local-Nkazakh	mostly local	1st grade	18
Djizak	Gala-aral	NKazakh-local	nd	extra-Uzbek	14-15
Tajikistan					
Sogdyi	Isfara	local	no	1st grade	20
Khatlon	Sargazan	local	no	whole meal	15
Dushanbe	Gissar	NKazakh-local	50-50	2nd grade	20

nd: not determined

The Wheat Milling Industry

Large to small commercial flour mills

The milling industry in CA countries is made up of old mills left over from the time of the Soviet Union, newly equipped large flour mills (capacity: over 50 t/day), as well as medium-size (10-50 t/day) and small (below 10 t/day) mills (Table 1). It supplies a large portion of the flour needed by the baking industry. Our survey indicated that in Kazakhstan, Kyrgyzstan, and Tajikistan a large portion of the milling industry has been privatized (Table 1).

Table 4. Tandyr bread-making survey. Basic ingredients and dough properties.

Country/County	City/town	Basic dough formula*					Dough consistency	Dough texture	Dough elasticity
		yeast %	oil %	salt %	milk %	water %			
Large to small commercial bakeries									
Kazakhstan									
Almaty	Almaty	1, dry	1	1	no	58-60	SS	smooth	good
Almaty	Chilik	1.5, fresh	0.4	1	some	50	SS	SR	good
Almaty	Uzin-A.	1.6, fresh	no	2.2	no	52	soft	smooth	good
Kyrgyzstan									
Chu	Novopok.	1.6, fresh	2	0.5	12	58	SS	smooth	good
Chu	Alexand.	0.4, dry	4	2	20	64	soft	SR	good
Osh	Osh	0.1, dry	no	2	24	68	soft	smooth	good
Osh	Osh	0.12, dry	no	2	1, dry	60	soft	smooth	good
Uzbekistan									
Andijan	Andijan	0.2, dry	no	1	no	62	SS	SR	little
Andijan	Andijan	1.5, fresh	no	1.5	no	48	soft	rough	little
Andijan	Assaka	0.3, dry	no	2	no	50	SS	smooth	good
Namangan	Namang.	0.5, dry	no	2	no	60	soft	smooth	good
Tashkent	Ukarach.	0.4, dry	6	2	20	60	soft	smooth	good
Djizak	Gala-aral	0.8, dry	no	2	no	60	SS	smooth	very good
Tajikistan									
Sogdyi	Gafurov	0.8, dry	2	2	no	56	soft	smooth	very good
Khatlon	Dangara	0.6, dry	no	1.4	no	64-70	soft & flowy	smooth	good
Dushanbe	Gissar	0.5, dry	no	1.7	no	50-60	soft	SR	good
Household bread-making (for sale)									
Kazakhstan									
Almaty	Chilik	0.4, dry	0.8	2	some	50	SS	SR	good
Kyrgyzstan									
Osh	Osh	3, dry	no	2.5	50	50	SS	rough	little
Tajikistan									
Sogdyi	Isfara	0.8, dry	no	1.4	no	60	soft	SR	good
Household bread-making (family consumption)									
Kyrgyzstan									
Chu	Kant	0.4, dry	no	0.8	no	50	stiff	rough	little
Osh	Tasharyk	0.1, sour dough		0.4	no	48-50	stiff	rough	little
Uzbekistan									
Andijan	Jana-Abad	10, sour dough		1	50	50	stiff	rough	little
Namang.	Jide-kapa	0.02, dry	1	1.5	33	66	SS	SR	fair
Djizak	Gala-aral	0.033, dry	no	0.4	no	50	SS	smooth	good
Tajikistan									
Sogdyi	Isfara	0.04, dry	no	1	40	50	SS	SR	little
Khatlon	Sargazan	sour dough		0.3	no	50-60	stiff	rough	little
Dushanbe	Gissar	0.08, dry	no	0.8	no	40-50	soft	smooth	fair

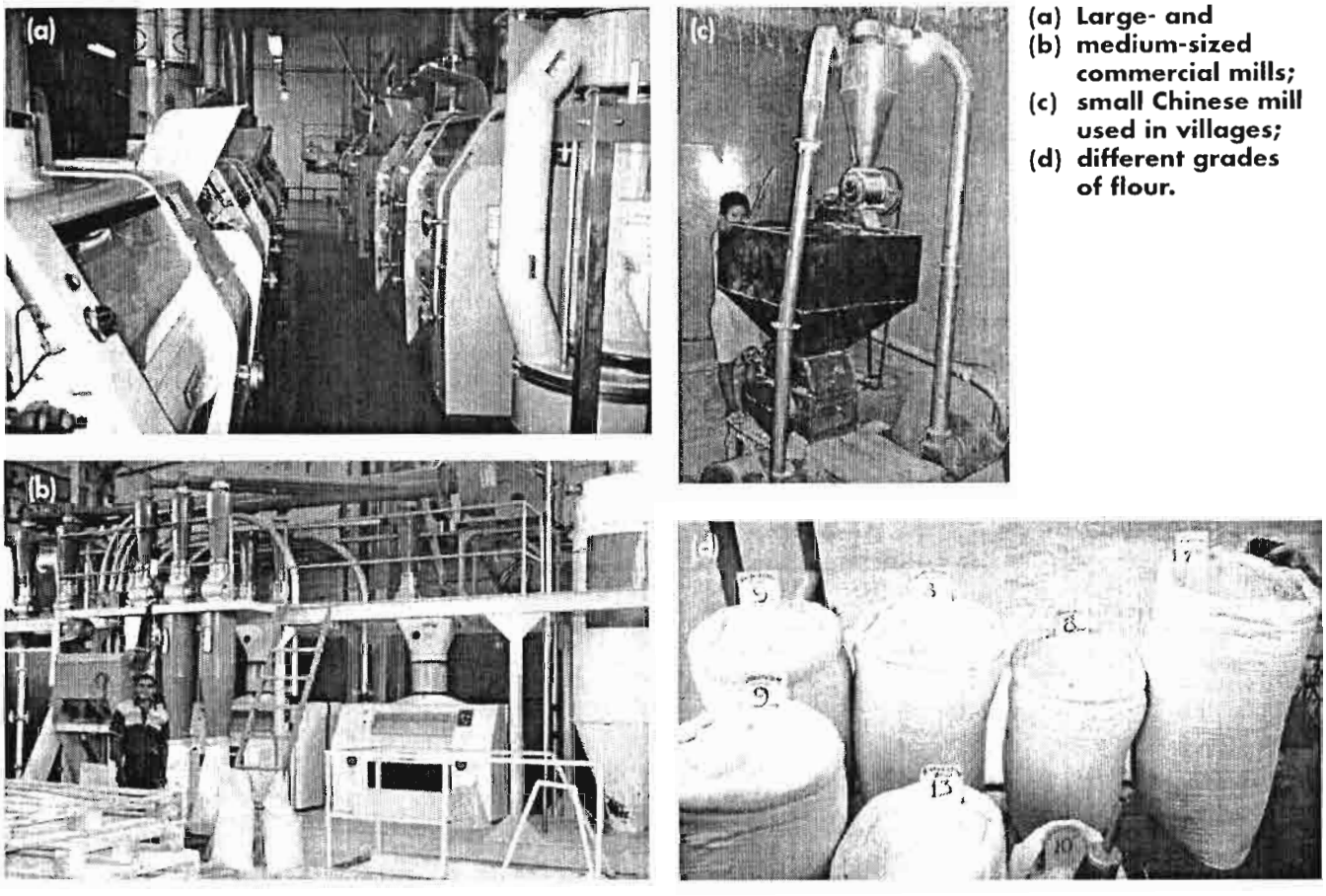
Based on 100% flour
SS= slightly stiff; SR = slightly rough

As previously indicated, the low production, inconsistent supply, and generally inferior bread-making quality of the locally produced wheat are the main factors driving the milling industry to import wheat from northern Kazakhstan (NK), except in Uzbekistan, where wheat imports are prohibited by the government. The wheat is purchased with quality certificates, allowing larger mills to store the grain according to gluten content. Separating grain in bins according to quality attributes gives millers the flexibility to blend locally produced wheat with NK wheat, when it is overly strong. NK wheat is blended with local wheat more frequently in Tajikistan than in southern Kazakhstan and Kyrgyzstan because of transportation difficulties to bring in NK wheat, especially during the wintertime.

Table 5. Tandyr bread-making survey. Bread characteristics.

Country/County	City/town	Diameter (cm)	Thickness (cm)	Crumb structure	Crust color	Weight (g)
Large to small commercial bakeries						
Kazakhstan						
Almaty	Almaty	35	5-7	slightly open	light brown	nd
Almaty	Chilik	15-20	5	slightly open	light brown	180
Almaty	Uzin-A.	20	7-8	slightly open	dark	600
Kyrgyzstan						
Chu	Novopok.	30 & 15	5	dense	brown	500
Chu	Alexand.	30-35	5-7	slightly open	light brown	750
Osh	Osh	15	5-7	open & elastic	light brown	180
Osh	Osh	15-20	5-7	open & elastic	light brown	160
Uzbekistan						
Andijan	Andijan	25-30	5-7	open & elastic	light brown	200
Andijan	Andijan	20-25	7-10	slightly dense	light brown	250
Andijan	Assaka	25	7	dense/dry/sticky	light brown	400
Namangan	Namang.	35	3-6	open &elastic	light brown	360
Tashkent	Ukarach.	30-35	7-10	slightly open	light brown	400
Djizak	Gala-aral	25	7-10	open & elastic	light brown	280
Tajikistan						
Sogdyi	Gafurov	20	5-7	open & elastic	light brown	290
Khatlon	Dangara	15-20	5-7	open & elastic	light brown	180
Dushanbe	Gissar	20	5-7	slightly open	light brown	250
Household bread-making (for sale)						
Kazakhstan						
Almaty	Chilik	35-40	5-7	dense	brown	780
Kyrgyzstan						
Osh	Osh	30-35	5-7	dense	light brown	500
Tajikistan						
Sogdyi	Isfara	15-20	5-7	very open	light brown	300
Household bread-making (family consumption)						
Kyrgyzstan						
Chu	Kant	20-30	5	dense &sticky	dark	500
Osh	Tasharyk	30-35	5	dense	dark	600
Uzbekistan						
Andijan	Jana-Abad	15-20	7	dense	light brown	450
Namang.	Jide-kapa	15-20	5-7	dense	brown	500
Djizak	Gala-aral	20	5-7	dense &sticky	brown	550
Tajikistan						
Sogdyi	Isfara	15-20	7-10	slightly open	brown	550
Khatlon	Sargazan	30-40	5-7	very dense	brown	850
Dushanbe	Gissar	25	5	dense & rough	brown	400

Commercial mills produce extra, first grade, and second grade flour types. Extra grade is the whitest (most refined) flour, while second grade is the darkest. Extra, first and second grade flours contain <0.6%, 0.7-0.8%, and 1.2-1.3% ash, respectively. Wet gluten content in flour obtained from NK wheat ranges between 26 to 32%, depending on flour type (Table 1). Surveyed staff from mills throughout the region consistently agreed that flour from CA winter wheat generally contains 3-4% less wet gluten than flour from NK wheat. According to the milling industry, first grade flour (27-30% wet gluten) from NK wheat, or from NK wheat-local wheat blends, yields medium strong gluten, which is adequate for making tandyr dough by hand (Table 1); if the gluten is too strong, it requires too much manual labor to develop the dough properly.



(a) Large- and (b) medium-sized commercial mills; (c) small Chinese mill used in villages; (d) different grades of flour.

Small service flour mills

Small Chinese flour mills (comprising only one set of rolls with adjustable roll gap) and stone whole grinders can mill (grind) 0.4-1 t/day and are privately owned (Table 2). These mills provide their services for 7-10% of the value of the total wheat lot. Small-scale farmers living in small villages far from the cities take their wheat crop to the service mills to obtain flour for their own consumption. Small Chinese service mills, count by the hundreds all over the rural parts of CA, process very large amounts of locally produced wheat. Because bakers recognize that NK wheat has better bread making quality, they sometimes purchase NK wheat to blend with local wheat and take it to the service mill to get higher quality flour (Table 2).

It is generally recognized that flour from local wheat is inferior to NK wheat flour for making tandyr bread; however, village people living far from the cities cannot afford to buy NK wheat or flour. Therefore, they consider flour from local wheat as satisfactory (Table 2).

Throughout our survey it was noticed that milling operations to obtain first and second grade flours using the Chinese mills vary widely from mill to mill. Variables such as gap distance between the rolls; number of times the intermediate milling products are passed through the rolls before the final refined flour is obtained; and length of time the grain is conditioned (with water) before it is milled are handled arbitrarily. The quality of the flour obtained from a wheat lot may be influenced by these variables, particularly in relation to ash content and water absorption. Gluten quality may also be deteriorated by heat during milling.

The Uzbekistan flour milling industry

The wheat milling industry in Uzbekistan differs in some ways from the milling industry in other CA countries. First, a large portion of the milling and baking industries belongs to the state (except for village-type service mills and bakeries). The government receives the wheat grain produced and stores it in large silos according to gluten content, and then distributes grain lots among large mills. It provides certificates for quality attributes (including test weight, gluten content, moisture, etc.). The flour extraction rate at the mills is also regulated by the government (78 to 82%, depending on the region). There are four flour grades: extra grade, first grade, second grade, and Uzbek grade. Extra grade flour is used mainly for cookies and French-type breads; first grade is used for tandyr bread, and second grade and Uzbek grade (0.8-0.9% ash) flours are used for producing cheap, dark, dense pan bread, called diabetic bread.

The main priority for the government is to achieve and maintain self-sufficiency in wheat production. Therefore, large bread making plants still use the very old sponge and dough-liquid fermenting process to produce low quality, high ash, dense pan-type bread, which is sold very cheaply. Because at present there is no requirement for high quality wheat, the government does not allow private mills to import wheat grain, but flour may be imported. However, the milling and baking industry recognizes that currently cultivated winter wheat varieties possess low gluten content and weak gluten character (Table 1, 2), and are unsuitable for producing high quality tandyr bread. Considering that consumption of tandyr bread has been increasing significantly, particularly in city suburbs and rural villages, there is a real need to improve winter wheat quality for the production of tandyr bread.

Table 6. Varieties known to produce good tandyr bread.

In southern Kazakhstan, Kyrgyzstan, and Tajikistan:	*In Uzbekistan:*
Saratovskaya 29	Tespizhor
Omskaya	Sanzar-8
Tselinaya	Polovchanka
Kazakhstan 10	Kupava
Belozyorka	Kroshka
Ontensivnaya	Umanka
Stekl. 24	Chillaki
Kras-ya 10	Starshina
Jagger (winter variety introduced from USA)	

Main Grain Quality Attributes of Local Wheat

Southern Kazakhstan, Kyrgyzstan, and Tajikistan

The main problems of local wheat are: low test weight, low protein content, low gluten content (below 20-22% wet gluten in grain), and weak gluten type (GDI = Gluten Deformation Index is about 120, which is considered low gluten quality). Insects and molds may damage grain lots during storage if not stored properly. Insect damage during grain maturation may also occur. Grain texture is generally from soft to medium hard. Soft, starchy grain is difficult to mill because the flour tends to clog sieves. The milling industry prefers medium hard wheat.

Uzbekistan

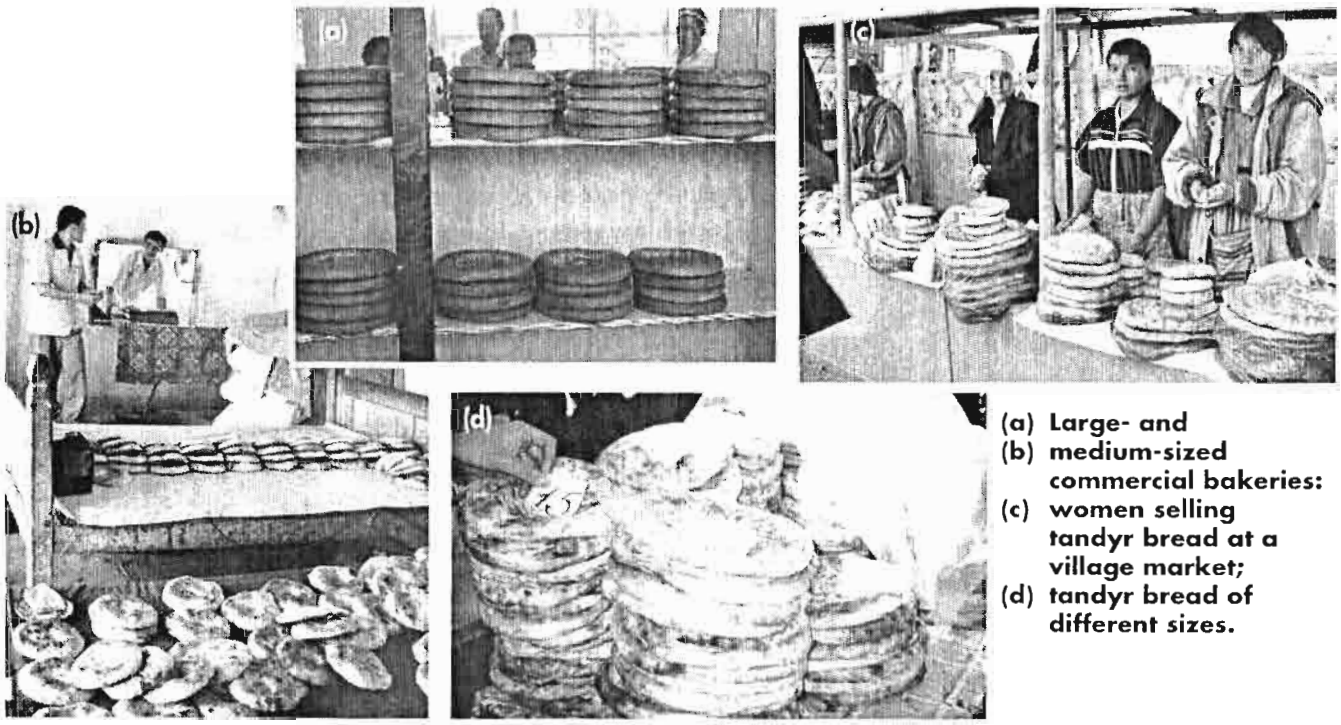
Local wheat has low gluten content (< % 20) and low gluten quality (GDI=115). In small village mills, problems with local wheat are sprouting, mold attack due to high moisture, and high proportion of starchy kernels (up to 50-60%). High incidence of starchy kernels indicates low protein content, which in turn could be caused by low Nitrogen fertilization of the crop and to N washed out from the soil by irrigation. Grain texture is in general semi-soft to semi-hard.

Grain quality is often affected by soil and dust contamination due to incidental collection of dust during combine harvesting or, more frequently, when threshing is done by driving a tractor over the wheat on the ground. Additional sources of contamination are the mixture of varieties and weed seed.

The Tandyr Bread Making Industry

Small to large tandyr bread bakeries

Large bread making plants manufacture mainly pan-type bread, and only a small portion of the flour consumed is used for making tandyr bread. In many cases tandyr bread is produced by baking the

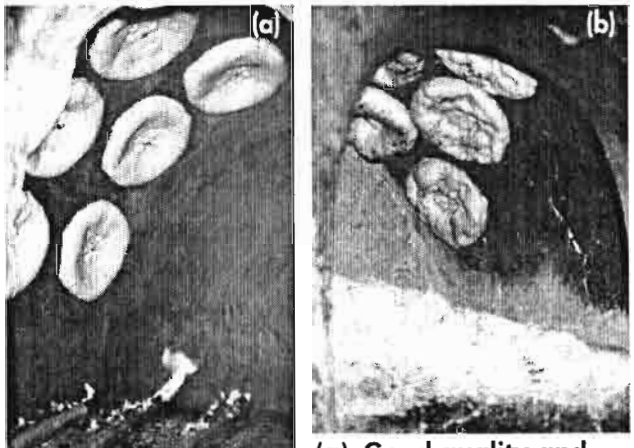


(a) Large- and (b) medium-sized commercial bakeries: (c) women selling tandyr bread at a village market; (d) tandyr bread of different sizes.

dough on the bottom of horizontal ovens rather than on the wall of concave clay ovens. The resulting bread has the general shape and size of tandyr bread, but its crumb texture and crust characteristics are different. This bread product is thus not considered **true tandyr bread** and will not be discussed further in this report.

Tandyr bread is manufactured mainly in large (actually medium-size) to small, privately owned bakeries. Tandyr bread bakeries are numerous and widely spread in large cities, towns, and large villages. The number of tandyr bread bakeries is limited by the size of the population in towns and villages and by the number of households producing bread for their own consumption. Tandyr bread is sold directly from the bakery, by vendors in the streets, or in large bazaars and local markets. A large commercial bakery located in a city or a large town may produce from 200 to more than 1500 bread units/day, while a small commercial household bakery produces from 50 up to 100 bread units/day (Table 3).

Most commercial bakeries in the region use first grade flour from NK wheat, either alone or blended with flour from local wheat. In Uzbekistan some commercial bakeries use only flour from local wheat (Table 3). Most of the bakers interviewed agreed that flour from local wheat has lower gluten content and lower dough water absorption than NK wheat flour. Many indicated that flour from local wheat also showed poor dough handling properties (dough stickiness) and poor baking quality (excessively flowy dough, which makes the bread discs hang wrong while stuck on the oven walls), and yielded fewer units of bread per kilogram of flour. In contrast, NK wheat flour was sometimes too strong (due to high gluten content), making it difficult to mix the dough. Hence, a blend of NK and local wheat flours produced the best flour properties (medium strong) to facilitate dough mixing, achieve good fermentation, and obtain high flour yield (units/kg flour) of good quality bread. The survey indicated that when flour is blended, a 50-50% NK-local flour blend is most frequently used (Table 3).

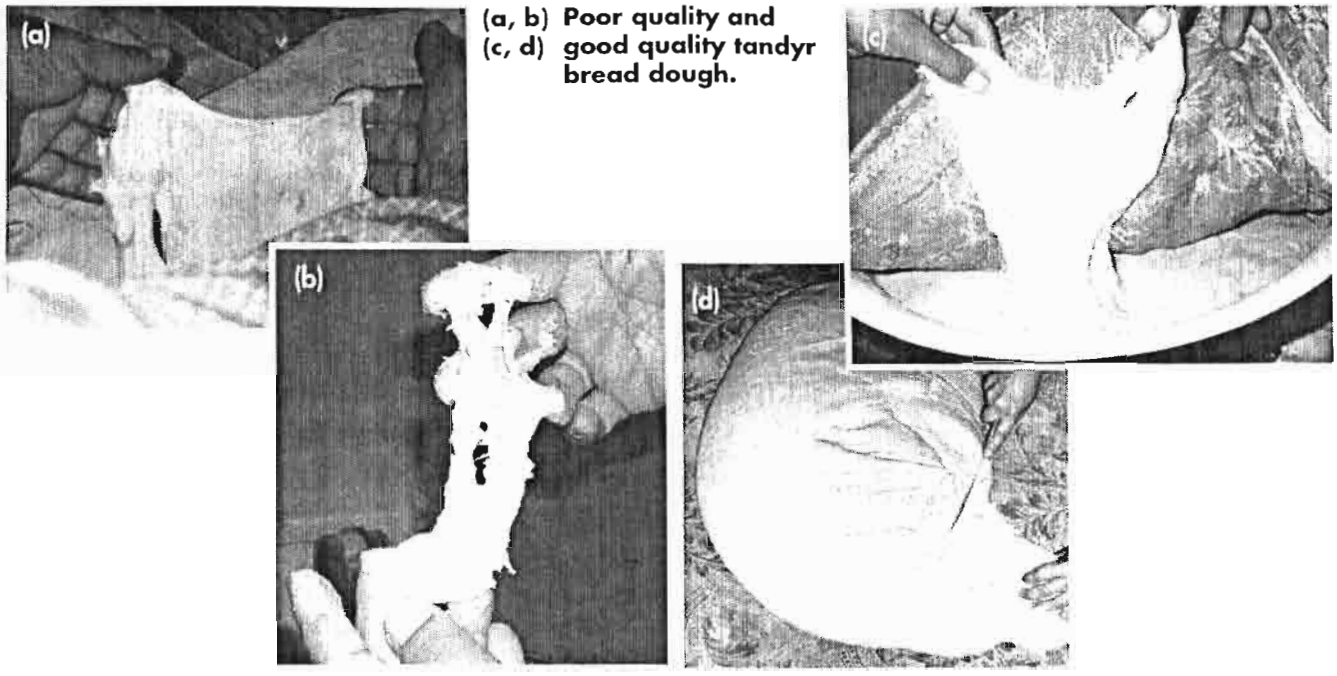


(a) Good quality and (b) poor quality tandyr bread dough.

The basic dough formula used in commercial bakeries includes flour, water, dry yeast (or, sometimes, fresh yeast), and salt. Bakeries in Kyrgyzstan frequently add milk to the formula (Table 4). Water is added to a 48-64% absorption level and, consequently, dough consistency varies from stiff to soft (Table 4). The fermented dough is generally smooth to slightly rough and possesses good elasticity and extensibility, necessary to flatten and extend the dough without further contraction. Dough with little extensibility tends to contract and lose the original dimensions given by the baker.

Commercial tandyr bread may be small, medium, and large in diameter, thickness, and weight. Bread size and weight depend on consumer preferences. Bread crust is generally light brown but crumb structure may vary from open in light weight breads to dense in heavy breads (Table 5). Bread produced in Uzbekistan is in general denser than in other countries of the region (Table 5).

The survey revealed that bakers believe that taste, color, and bread satiation capacity—in that order—are the most important bread factors for the consumer (Table 7). Bread storage life (retention of freshness/

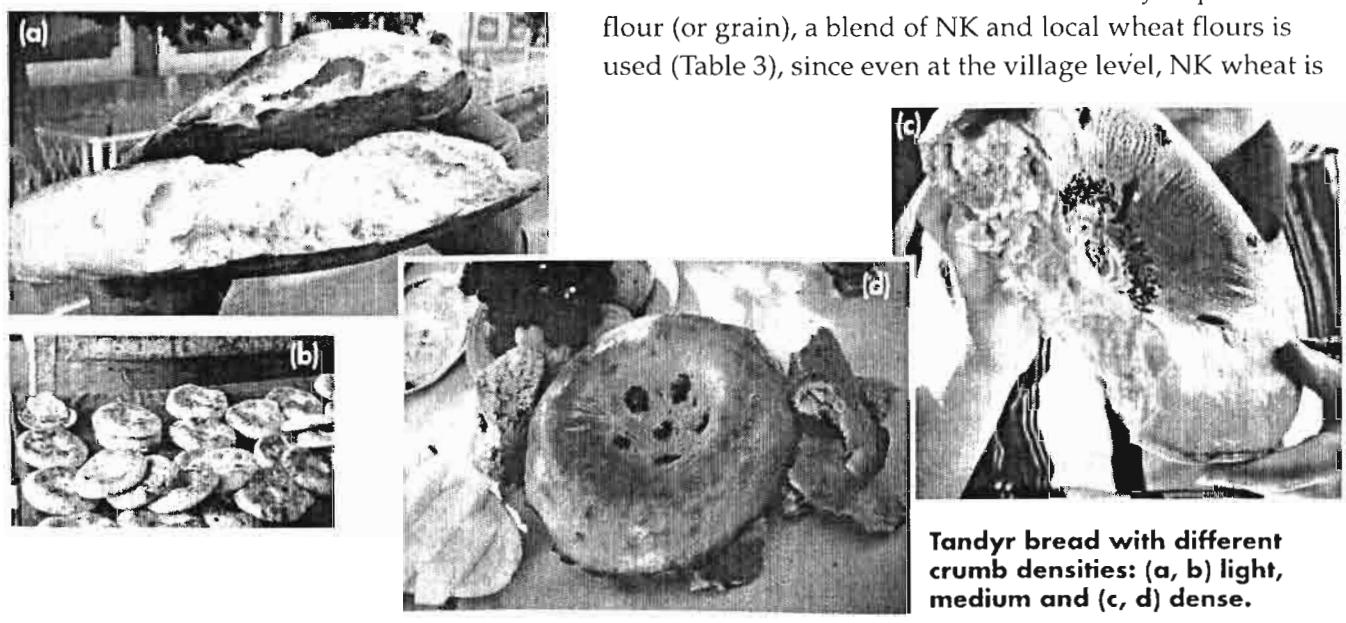


(a, b) Poor quality and (c, d) good quality tandyr bread dough.

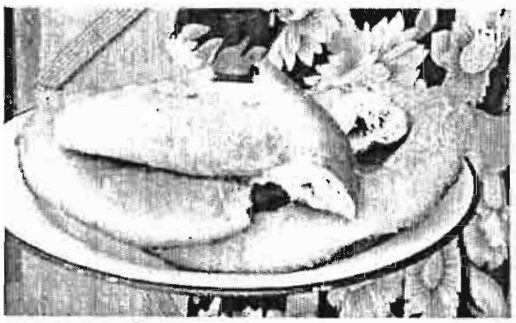
softness) is not very important for the consumers of baker's bread because they buy just enough to avoid eating stale bread. Baker's tandyr bread may last from one day to one week (Table 7), depending on storage conditions. Per capita consumption of tandyr bread may vary from as little as 181 g/day, when bread complements a full meal, to more than 500 g/day, when it is the main component of the meal (Table 7).

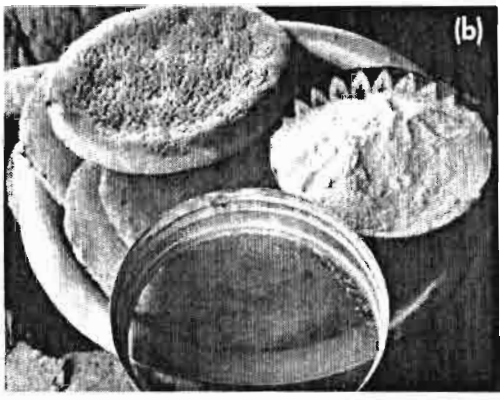
Household tandyr bread making

Household bread making is widespread in small villages located far from the larger towns and cities. For household bread making directed towards family consumption, either flour is purchased on the market or farmers take their own wheat grain to the local Chinese-type service mill. Household bread making is generally made from local wheat flour, mainly because it is cheaper than imported wheat flour. However, when the household baker can afford to buy imported flour (or grain), a blend of NK and local wheat flours is used (Table 3), since even at the village level, NK wheat is



Tandyr bread with different crumb densities: (a, b) light, medium and (c, d) dense.





(a, b) Tandyr bread made of whole grain flour. The crumb of this bread is very dense.

Table 7. Tandyr bread-making survey. Preferred bread characteristics, shelf life, and per capita consumption.

Country/County	City/town	Most important bread characteristics	Storage life (covered)	Per capita consumption g/day, calculated
Large to small commercial bakeries				
Kazakhstan				
Almaty	Almaty	nd	4	nd
Almaty	Chilik	Taste, crumb texture (CT), color	3	nd
Almaty	Uzin-A.	Taste CT, storage life (SL)	nd	nd
Kyrgyzstan				
Chu	Novopok.	Color, SL, satiation	3	269
Chu	Alexand.	Color, satiation	5	450
Osh	Osh	Taste, crumb texture	3	360
Osh	Osh	Color, taste	3	nd
Uzbekistan				
Andijan	Andijan	SL, taste, high volume	8	222
Andijan	Andijan	Color, bread yield	3	nd
Andijan	Assaka	nd	nd	nd
Namangan	Namang.	Taste, color, volume	1	257
Tashkent	Ukarach.	Taste, satiation, volume, color	3	181
Djizak	Gala-aral	Satiation, taste, color	5	720
Tajikistan				
Sogdyi	Gafurov	Color, taste, satiation	2	nd
Khatlon	Dangara	Taste, satiation, volume	4	nd
Dushanbe	Gissar	Volume, taste, color	3	375
Household bread-making (for sale)				
Kazakhstan				
Almaty	Chilik	Taste, crumb texture, color	nd	390
Kyrgyzstan				
Osh	Osh	Taste, color, satiation	nd	286
Tajikistan				
Sogdyi	Isfara	Color, satiation, taste	2	nd
Household bread-making (family consumption)				
Kyrgyzstan				
Chu	Kant	Taste, crumb texture	3	250
Osh	Tasharyk	Color, taste, satiation	4	257
Uzbekistan				
Andijan	Jana-Abad	Taste, storage life, satiation	6	225
Namang.	Jide-kapa	nd	4	292
Djizak	Gala-aral	Storage life, satiation	5	321
Tajikistan				
Sogdyi	Isfara	Taste, color, satiation	nd	454
Khatlon	Sargazan	Color (crumb whiteness)	4	800
Dushanbe	Gissar	Taste, color, texture	5	400

nd: not determined

Satiation: dense crumb that is bulky and satisfying when eaten. crumb texture: elastic, nonsticky is preferred.

known to produce better quality flour than local winter wheat. Household bakers prefer first grade flour because it produces whiter bread. However, the poorer village population uses cheaper second grade flour or whole-wheat flour to produce dense, dark brown bread, which has high satiation capacity.

When tandyr bread is made at home, the baker uses less yeast than in commercial bakeries (Table 4) and produces stiff to slightly stiff dough (mainly due to high fiber content of the flour grade commonly used) that is generally rough and less cohesive than the dough prepared in commercial bakeries (Table 4). This kind of dough has limited elasticity and extensibility and, therefore, tends to separate from the oven wall and fall during baking. Two main reasons why unbaked dough of these characteristics tends to separate from the oven wall and fall is its heavy weight (Table 5) and rough dough surface, which does not stick to the wall as well as smooth dough. The resulting bread generally has a dense crumb that tends: 1) to be sticky during mastication (Table 5), and 2) to absorb saliva, making it difficult to masticate and swallow.

Household bakers generally pointed to bread satiation capacity and/or crumb texture (which are related) as the most important bread quality factors, followed by taste and color (the whiter the better). Bread storage life was also considered important in two households in Uzbekistan (Table 7).

Conclusions and Recommendations

Conducted in mills, bakeries, and households across four Central Asian countries, our survey clearly indicated that winter wheat varieties currently cultivated in the region possess inferior quality for the production of tandyr bread. There is thus a real need to improve winter wheat quality and make local varieties acceptable for the tandyr bread making industry and to gradually reduce wheat imports associated with wheat quality issues.

Winter wheat germplasm is already being testing for adaptation and agronomic performance throughout the region. It should also be evaluated for relevant quality traits such as gluten quality and quantity to be able to identify cultivars combining good agronomic traits, acceptable disease resistance, and desirable quality attributes. The winter wheat variety Jagger was indicated as satisfactory for tandyr bread making quality and could be taken as a standard or quality reference.

The CIMMYT-Kazakhstan office has already identified laboratories in Almaty (Dr. A. Abugalieva, Kazakh Research Institute of Farming), Bishkek (Dr. Mira Djunusova), Gala-aral (Biochemist Aref Ablaqulov, Ara-aral Grain Institute and Inspection Laboratory). These laboratories have the necessary infrastructure to determine grain protein, sedimentation (rough gluten strength index), Gluten Determination Index, and Farinograph dough properties. No quality laboratory has as yet been identified in Tajikistan.

In addition, the best lines/varieties from CIMMYT International Nurseries could be tested in for whole-grain milling and whole-grain tandyr bread making in Zargazan village (Tajikistan) with Mr. Imamnazar Husainov (Kulyab Zonal Experiment Station of the Farming Institute, Dangara District). In this specific case bread quality attributes to evaluate include dough stickiness, bread taste, and bread stickiness during mastication, mouth drying (saliva absorption) during mastication, and ease of swallowing of masticated bread.

Winter wheat quality is affected by agronomic practices, especially nitrogen fertilization, which influences grain protein content. There was high incidence of starchy kernels in many grain lots of winter wheat cultivars visually examined in the mills. This is certainly an important factor affecting gluten content and bread making quality.

The wheat quality laboratory at CIMMYT Headquarters could determine the biochemical (glutenin) composition of winter-facultative germplasm and recommend the best quality parents to be used in improving the bread making quality of winter wheat for CA countries. Systematic work including breeding and agronomy research and the establishment of a collaborative network for quality testing among the four countries should result in a substantial improvement of the tandyr bread making quality of winter wheat cultivated in CA.

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Evaluation of the wheat grain quality requirements for *nan (tandyr, lepyoshka) bread* in Central Asia
Survey questionnaire: Baking industry / household

Name of enumerator:

Country _____ Region _____ County _____ City/town _____ Profession/job _____	
No of Bakeries in the location	Large: _____ (above _____ flour Kg /day) Small: _____ (below _____ flour Kg/day)
Size of Bakery No of nans produced per batch? No of batches baked per day?	Large _____ Small _____ Home _____
Origin of flour / grain lot **Type of mill to grind grain at home**	Mill _____ Market _____ Farm _____ Stone: _____ Other: _____ Specify:
Name of wheat variety (ies) (in order of quality importance: 1, best; 4, worst)	1. 2. 3. 4.
Preferential traits for grain	Color: white _____ red _____ Size: small _____ large _____ Grain texture: soft _____ hard _____ Protein: _____ % (%mb)
Best flour brand for flat bread Name/Source:	Why? Price _____ Easy to make and handle dough _____ Bread softness _____ Bread keeps fresh for longer time _____
Flat (nan) bread formula	Flour: _____ yeast ( ): _____ salt: _____ Other: _____ Water: _____
Dough making method	Mixer speed: High _____ Medium _____ Low _____ Mixing time _____ Mixed by hand _____
Dough properties	Stiff: _____ Soft: _____ Extensible: _____ Non extensible: _____
Fermentation time	

Dough shaping	Press, automated _____ Press, hand operated _____ Dough roller _____
Oven type: Dough sticked on the wall: Heating material: **Oven Steaming:**	Clay _____ Brick _____ Other _____ Yes _____ No _____ Gas _____ Fuel _____ Wood _____ Yes _____ No _____ Oven temperature: _____ Baking Time: _____
Bread characteristics Name of bread: _____	Shape _____ Diameter _____ Thickness _____ Weight _____ Texture: soft _____ stiff _____ **Importance of:** Rollability (Folding): High _____ Low _____ Taste: High _____ Low _____ Texture: High _____ Low _____ Color: High _____ Low _____ Storage life: High _____ Low _____
Use of bread	For sale _____ family consumption _____ Both _____
Number of breads consumed per person per year	_____
Relative frequency of purchasing, or producing at home, nan bread	_____
Frequency of baking	_____
Average storage life for bread	_____
Maximum storage life for bread	_____
What is done with stale bread	_____
Comments:	

Evaluation of the wheat grain quality requirements for *nan (tandyr, lepyoshka) bread* in Central Asia
Survey questionnaire: Milling Industry

Name of enumerator:

Country _____ Region _____ County _____ City/town _____ Profession/job _____	
No of Mills in the location	Large: _____ (above _____ flour Kg /day) Small: _____ (below _____ flour Kg/day)
Name of Mill	
Origin of grain lot Reasons to import wheat	Local: _____ Imported: _____ Not enough local supply _____ Quality _____
Name of wheat variety (ies) (in order of quality value: 1, best; 5, worst)	1. 2. 3. 4. 5.
Main problems with local wheat:	Color _____ Size _____ Hardness _____ Sprouting _____ Protein content _____ Poor baking quality _____ Variable baking quality _____ Other _____
Milling of: Individual wheat varieties Mixture of wheat varieties Reason for mixing varieties Bins/ silos to separate by quality type	 Yes _____ No _____ Yes _____ No _____ Tradition _____ Quality _____ Other _____ Specify: Available _____ Not available _____
Preferential traits for grain	Color: white _____ red _____ Size: small _____ large _____ Texture: soft _____ hard _____ Protein: _____ % (%, mb)
Preferred gluten type	Strong: _____ Medium: _____ Weak: _____ Extensibility is important? Yes _____ No _____
Flour use (extraction: _____ %) (extraction: _____ %) (extraction: _____ %)	Pan type bread: _____ % Leavened bread: _____ % Flat (nan) bread: _____ %

Preferential flour traits for:	Pan type _____ Leavened _____ Flat (nan) _____ bread _____ breads _____ breads _____
Color Ash Protein (% mb) Gluten strength (strong, medium, strong, extensible)	
Comments:	

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